Ontario Ministry of Natural Resources

FOREST RESEARCH NOTE

1985 No. 40

Performance of Black Spruce Accelerated Transplants after Five Years

G.D. Racey, R.E. Hutchison and C. Glerum

Black spruce (Picea mariana (Mill) B.S.P.) accelerated transplants (ATP), also called greenhouse transplants, are now being produced on an operational basis at some Ontario tree nurseries (Cavalier 1984a, 1984b), and it is expected that ATP production will increase significantly in the next few years. Since a large proportion of black spruce planting stock will be ATP rather than the conventional 1.5 + 1.5 transplant and 3+0 seedling, it is important to know how the field performance of the ATP stock type compares with the regular stock.

In this note five years of field performance of black spruce accelerated transplant stock is compared with that of conventional bare-root stock. It is realized that the ATP technology has been altered considerably since the first Ontario trials with 'Finn-house transplants' at the Swastika Nursery in 1975. The technology for producing ATP has changed considerably from that used 5 years ago but the desirable attributes and objectives of the program remain unchanged. A comparison of ATP stock with conventional stock is useful because it will ensure that the new stock types that we are producing continue to be of high quality.

Materials and Methods

Two trials were conducted, one in 1979 and one in 1980, to compare the field performance of several black spruce stock types. The black spruce ATP stock was produced in a "Finn" style greenhouse which was constructed over a nursery bed (Mahonen 1976). The ATP stock types were 4G + 2.5, 4G + 2, 4G + 1.5 and 4G + 1. The symbol 4G means 4 months in the greenhouse while the other number stands for the number of years in the transplant beds.

1979 Trial

In this trial, the 4 black spruce stock types were: 1.5 + 1.5, 3+0, 4G + 2.5 and 4G + 2. All stock was lifted from the nursery beds on May 27, 1979, packed in multiwalled kraft poly bags and taken to the planting site where the stock was heeled in on the same day.

The trees were planted the next day in a randomized complete block design with 4 treatments, 5 blocks and 200 trees per plot. The planting

Further information may be obtained from:

Ontario Tree Improvement and Forest Biomass Institute
Ministry of Natural Resources
Maple, Ontario L0J 1E0

site was a sandy podzol with moderate to heavy slash and had been barrel scarified. The seedlings were planted at approximately 1 m intervals in rows.

1980 Trial

In this trial, the 5 black spruce stock types used were: 1.5 + 1.5 large, 1.5 + 1.5 small, 4G + 2, 4G + 1.5, and 4G + 1. All stock was lifted May 14, 1980, packaged, and transported to the planting site where all stock was heeled in on the same day.

Planting was done May 15, 1980 in a randomized complete block design with 5 treatments, five block and 200 trees per plot. The spacing was approximately 1 m within rows and 2 m between rows. The site was a deep silty sand with moderate to heavy competition, and had been scarified with barrel and chains.

At the time of planting, samples of 100 seedlings per stock type were collected for stock characterization measurements. The parameters measured were stem diameter 0.5 cm above the root collar, top length from the root collar to the base of the terminal bud and top and root dry weights.

Five years after outplanting the total height, current annual height increment and survival were measured. The data were subjected to analysis of variance followed by Duncan's new multiple range test.

Results and Discussion

At time of planting the ATPs in the 1979 trial were significantly larger in stem diameter, top length and oven dry weight than the conventional bare root transplant or seedling stock (Table 1). The 4G + 2.5 ATP was not significantly larger than the 4G + 2 ATP and both were significantly larger than the regular bare root 1.5 + 1.5 (Table 1). In the 1980 trial the 4G + 1 ATP was significantly smaller than the 4G + 1.5 for all parameters measured while the 4G + 1.5 and 4G + 2 were about equal in size. The latter were larger than the small 1.5 + 1.5 but about the same as the large 1.5 + 1.5.

It is clear that with the accelerated transplant technique stock of comparable size to regular 1.5 + 1.5 transplant stock can be produced in less than 3 years, which is important since with spruce the size of shipping stock is important to its field performance (Mullin and Svaton 1972).

There was no significant difference in survival five years after planting in the 1979 trial but there was a significant difference in the 1980 trial, with the survival of the 4G + 2 being considerably poorer than that of the other stock types (Table 2).

In the 1979 trial there were significant differences in fifth year total height and annual increment between the ATPs and the regular nursery stock. The 3+0 stock type performed significantly poorer than any of the other stock types. In the 1980 trial there were only small differences in fifth year total height and annual increment. The small 1.5 + 1.5 stock type was significantly smaller after five years than the large 1.5 + 1.5 stock type demonstrating once again, the importance of initial size at time of shipping, to subsequent growth.

TABLE 1 Stock characterization parameters of regular nursery bare root stock and accelerated transplant black spruce used in the trials

Stock type	Top length (cm)	Stem diameter (cm)	Top O.D.W. (g)	Root O.D.W. (g)
1979 Trial				
1.5 + 1.5	21.9 c	.447 c	4.21 d	1.76 b
3+0	28.1 b	.441 c	5.85 c	1.14 c
4G + 2	29.8 ab	.530 b	8.27 b	1.87 b
4G + 2.5	32.2 a	.611 a	11.42 a	2.65 a
	***	***	***	***
1980 Trial				
4G + 1	20.09 d	.327 c	2.62 d	0.80 d
1.5 + 1.5 (small)	22.16 c	.466 b	4.89 c	1.65 c
4G + 1.5	27.23 b	.519 a	6.81 b	2.06 ab
4G + 2	28.18 b	.554 a	9.11 a	2.38 a
1.5 + 1.5 (large)	30.66 a	.512 a	6.60 b	1.83 bc
	***	***	***	***

*** statistically significant at 99.9% level
Numbers followed by the same letter are not significantly different at the 95% level.

TABLE 2 Fifth year height, current annual increment and survival of accelerated transplant stock vs regular bare root black spruce seedlings

Stock type	Total height (cm)	Current annual increment (cm)	Survival (%)
1979 Trial			
1.5 + 1.5	75.9 b	21.1 a	91.5
3+0	62.6 c	17.4 b	84.6
4G + 2	77.5 ab	21.1 a	86.7
4G + 2.5	82.3 a	22.5 a	85.8
	***	***	ns
1980 Trial			
4G + 1	77.8 b	22.0	94.0 a
1.5 + 1.5 (small)	77.8 b	20.8	92.8 a
4G + 1.5	86.6 a	22.6	92.4 a
4G + 2	83.8 a	21.2	75.8 b
1.5 + 1.5 (large)	87.8 a	21.8	89.2 a
	*	ns	***

* statistically significant at 95% level
*** statistically significant at 99.9% level
Numbers followed by the same letter are not significantly different at the 95% level

The ATP stock that is currently produced, is 3G + 1 (overwintered crop) and 4G + 1 (current crop) but these were not tested here. However, the comparisons made here generally demonstrate that ATPs performed well when compared to conventional planting stock. This comparison also demonstrates the importance of large stem diameter and total dry weight to good subsequent growth. The major point to be made is that high quality shipping stock can be produced in two years instead of three. With the further development of the ATP program at many Ontario nurseries, the quality of ATP stock can be further improved. However, it will require continued testing and evaluation of the new stock types.

Literature Cited

Cavalier, C. 1984a. Procedures and results of the accelerated transplants products project. Ont. Min. Natur Resour. Internal Report. 37 p.

Cavalier, C. 1984b. Accelerated transplant produces program at the Swastika Forest Station. Ont. Min. Natur. Resour. Internal Report. 81 p.

Mahonen, C.K. 1976. Acceleration of black spruce in "Finn" style greenhouse for 1-1 transplant production. Ont. Min. Natur. Resour. Internal Report. 16 p.

Mullin, R.E. and J. Svaton. 1972. A grading study with white spruce nursery stock. Comm. For. Rev. 51: 62-69.

3386
(.8KP.R.85 06 24)
ISSN 0381-2650